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ABSTRACT

In Creswell (Oregon) High School's award winning vocational education program, students study energy efficient construction along with basic building skills. Part of the program has been the active recruitment of female, minority, disadvantaged, and handicapped students into the vocational area. Students have assembled solar hot water collectors, built a passive solar greenhouse, organized a touring energy road show, and gained state and national recognition for their efforts. This publication explores the history and development of Creswell's energy efficient construction program and analyzes its implications for other schools. (Author/MLF)

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OSSC BULLETIN

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Creswell's Energy Efficient Construction Program:
A Big Project for a Small School

Bruce Kelsh

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Preface

An earlier OSSC Bulletin, "Energy Conservation: What Schools Can Do Now," pointed out ways that schools can face the challenges of energy conservation. That Bulletin was written by Dr. Stuart Young, superintendent, and Jim Richmond, teacher and energy coordinator for the Creswell School District.

Creswell has continued its commitment to energy conservation. This Bulletin examines Creswell's introduction of an energy conscious philosophy into its vocational curriculum. In these financially difficult times, Creswell believes that its energy efficient construction program is one of the ways schools can save money while maintaining a quality curriculum.

The construction cluster implemented by Creswell stresses solar energy. Two of the outstanding features of this program have been the building of solar hot water collectors and a solar greenhouse. Students enrolled in construction classes at Creswell have gained state and national recognition for their efforts.

This Bulletin explores the history and development of Creswell's energy efficient construction program and analyzes its implications for other schools.

The author, Bruce Kelsh, is a graduate research assistant for the Oregon School Study Council.

Philip K. Piele
Executive Secretary

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Introduction

"Pretty button-poppin' proud" is the way Cottage Grove's Sentinel described Creswell High School's response to the announcement that it was receiving yet another award for its construction program. "We're proud of our project and our students," said Superintendent Stuart Young.

Creswell's energy efficient construction cluster has brought state and national recognition to this double "A" size Oregon school during the past three years. Creswell is eager and willing to share its ideas for an outstanding vocational program with other schools. "Our project might serve as a model for other small schools in the state who are trying to start vocational programs," states Jim Richmond, Creswell's construction teacher.

Since the construction cluster was introduced to the school's curriculum in 1979, Creswell students have studied energy efficient construction along with basic building skills. They have assembled solar hot water collectors and organized a touring Energy Road Show. They built a passive solar greenhouse for the school. A number of students attended an international energy conference in Vancouver, B.C. Two students went to Washington, D.C., to accept special recognition for the school. Another student was appointed state director for Oregon Energy Education Day 1982. The instructor has been invited to speak at regional conferences throughout the United States. There is no question that Creswell's project has had an impressive history.

The Program Takes Shape

The construction program's origins go back to November 1978 when the Oregon State Department of Education sent out a Request for Proposals to Improve the Quality of State Approved Vocational Programs. Creswell was one of the few school districts that responded. At that time Jim Richmond was an "older than average" first-year social studies and welding teacher at Creswell High School. He was a vocational trades graduate of Oregon State University and a former student of D.R. Knapp's energy education classes at Linn-Benton Community College. He was thirty-two and an energy activist.

At the suggestion of Candy Boyd, career education coordinator, Richmond worked together with her to submit a proposal to the State Department. They designed a vocational construction program with special goals. The plan had the backing of then high school Principal Stuart Young and Superintendent Don Rees. The proposed program had three main goals: (1) to increase the number of students in the vocational program by 10 percent, (2) to decrease the dropout rate, and (3) to increase the job readiness skills of students. The proposal included plans to actively recruit women, minorities, disadvantaged, and handicapped students into the vocational area. Career counseling and instructional media would be used to assist all students in the project.

Energy efficient construction concepts and techniques were stressed. Student projects were specified in the request for funds. Students would build solar hot water collectors, storage buildings, and a passive solar greenhouse that would be used by the school's vocational agriculture class.

The grant application covered the general objectives of the vocational construction program. It detailed course descriptions and outlines and explained expected learner outcomes and evaluation standards.

The district's financial commitment to the project was to be $11,545, consisting mainly of instructional salaries and about $900 for materials. The request for state/federal funds came to $16,244. The awarded funds would be used primarily for first-year supplies and a summer salary for an instructor. Early in 1979 the Department of Education announced that Creswell's application for funds had been approved for the 1979-80 school year.

Construction Cluster Curriculum

"You can teach house building without having to build houses. This will not be a house building class," Jim Richmond firmly stated. "We'll use a solar greenhouse and solar collectors as the teaching mechanisms to teach all the phases of construction. In a solar greenhouse you have the foundations, the siding, the walls, glazing, all of that--virtually everything you'd have in a house."

With those words as its manifesto Creswell's energy efficient construction program was planned as a two-year sequence. Construction I was open to sophomores as well as juniors and seniors because of the relatively small size of the high school (about three hundred students). This encouraged early involvement in vocational classes. Construction II would complete the basic core curriculum. In their senior year, students who entered as sophomores could elect to take an individualized course titled Construction Supervision. There they would act as work supervisors for Construction I and II students under the direction of an instructor.

Senior students could study leadership skills or participate in a cooperative work experience program that would be established.

The emphasis in the vocational classes was on energy efficiency. Using a variety of audiovisual materials, students learned about wind energy and solar energy systems, domestic solar hot water installations, passive solar designs, and energy efficient construction. They also learned about conventional building materials and techniques through classroom lectures and the use of media instruction. Study preceded any hands-on projects. Actual building thus became the application of theories and knowledge.

Recruitment of Students

"What I saw was the possibility of developing a program that was exciting, that would attract kids, and would give kids who had not experienced much success in high school a chance to feel good about themselves. Having achieved a measure of success in school, maybe they'd stay in school," said Jim Richmond. "A lot of the kids we first attracted to the program I would refer to as the outlaws and desperados of the school. But a lot of those outlaws and desperados went places in the school when they got involved in something that felt good to them."

As the instructor, Richmond actively recruited a wide range of students to the construction cluster. In accordance with project goals, he especially encouraged female, handicapped, and disadvantaged students as well as potential dropouts. Several students that first year had minimal shop experience. Some had none. Others had Individualized Education Plans and had to learn the rudiments of basic measurement. Many had to learn basic construction math and basic use of hand and power tools. Shop and on-the-job safety lessons were an important part of early instruction.

History of Implementation

Initial Summer Session

Implementation began with a ten-week summer program in 1979. Of the eight students in the summer class, half were females. "The summer session provided a less threatening climate to girls enrolled in originally masculine identified tasks than the regular school year," explained Richmond, instructor and supervisor of the summer venture.

The course was coordinated with Lane County CETA, which provided hourly wages for the students who financially qualified. The high school offered half a credit for completion of the ten weeks. Ten hours a week were spent in classwork and thirty hours a week in construction. Students were able to earn cash and credit for their efforts.

Students worked on two major projects and an assortment of minor ones that summer. They designed and built a twenty-four by thirty-two feet covered smoking area located beneath fir trees in front of the high school. Students ordered materials and tried to harmonize architecturally the smoking area with the other school buildings. This was not an easy task and took several attempts before it was built correctly. The job was complicated by a large fir, growing in the middle of the proposed site, that had to be incorporated into the structure.

A second major project was the design and initial enclosure of an area behind the school shop. Students who had never before handled concrete poured over one hundred and twenty square feet of variable height foundation. Walls were framed and partially finished. The group also performed building maintenance and built a shop media center. They also assisted in the evaluation of construction, safety, and solar energy slideshows and film-strips to be used during the school year.

Jim Richmond viewed the summer program as quite successful: "We were trying to get women involved from the beginning, to set the pattern that this is a women's course too, not just a class for guys in the shop." Two of the female summer students signed up for the construction course in the fall. One of them later became the vocational organization president. The other two women enrolled in vocational classes at Lane Community College in the fall. Two of the male students enrolled in the high school's vocational program, and a third took a job as a cabinetmaker.

The First Year

The construction cluster curriculum began in the fall of 1979. Sixteen students, four of them veterans of the summer session, enrolled in Construction I. The first year was critical in providing students with basic skills and concepts related to energy efficient construction. As two of their major building projects, students assembled solar hot water collectors and began the solar greenhouse.

One of the first things Creswell ordered with the state grant monies was a 35mm camera. During the first semester Jim Richmond taught seminars in photographic techniques so that students could document the building and installation of solar collectors. Each student received basic instruction in photography and took a turn as project photographer. The class kept a slide record of its accomplishments. "Everything we ever did has been documented," said Richmond. "We now have over 4,000 slides."

Students tackled a number of other projects in order to gain experience before undertaking the solar greenhouse. They refined their pipe trade skills by designing the school shop's pneumatic system, cutting and threading the pipe, and installing the system. Using building skills they put finishing touches on the smoking area by building benches, framing the slab

enclosure, applying siding, and constructing and installing doors. Student work crews also built a small storage shed used by the football team and undertook several facility improvement projects for the school. All these activities helped prepare them for the most ambitious project of all--the solar greenhouse. Construction began on the greenhouse during the school year.

Summer 1980

Work on the greenhouse continued into the summer of 1980. Nine students were enrolled in the second summer session. Once again coordination with CETA made this a "credit with pay" ten-week program. Students were paid $3.10 per hour for their four ten-hour days a week. In addition to the greenhouse, students worked on new offices for the school shop and district storage buildings. Of the nine students in the summer class, all but one eventually became involved in the vocational construction program during the school year.

The big event of the summer was Solwest '80, the international solar conference held in Vancouver, B.C., in August. It was the Canadian national conference of the Solar Energy Society of Canada organized in conjunction with the regional conference of the Pacific Northwest Solar Energy Association. Creswell's renewed state/federal grant included $3,000 toward student expenses for the trip. Eleven students were able to go to Vancouver using a combination of their own and grant funding.

Creswell's representatives were the only high school students at the conference attended by 2,000 people. They had been invited to present a slide show and talk about the school's solar greenhouse. The slide show was well attended and well received by conference participants. Creswell

students spent the remainder of the time examining solar exhibits, going on solar tours, and listening to international experts speak on solar energy.

As well as learning more about solar energy, the trip itself was a learning experience. "I came back with a group of kids who had left the small town of Creswell with a small town outlook and had been exposed to a large, foreign, metropolitan city," said Richmond. "Overall, the cultural experience was incredible. It really changed some lives."

The Second Year

State and federal funding was renewed for the second year of energy efficient construction in Creswell. The second grant was for $14,989, and the district increased its portion to $4,000 plus instructional salaries. 1980-81 was the first school year that both Construction I and Construction II classes were offered in the curriculum. Sixteen percent of the total high school enrollment of three hundred signed up for vocational construction classes. Fourteen students were in Construction II and thirty-four altogether in the two sections of Construction I. As in the first year of operation, career counseling and instructional media were incorporated into the program. Students were identified in the following ways:

9 were female
39 were male
23 were classified as economically disadvantaged
16 were classified as handicapped under P.L. 94-142
1 was partially of Native American descent
1 was partially of Phillipino descent

Twelve of the sixteen handicapped students were also classified as economically disadvantaged.

Creswell's efforts in solar energy did not go unnoticed. In December the American Institute for Research in the Behavioral Sciences chose Richmond

to be on its national panel of eight energy education experts to work on a federal grant. Creswell student Rogelia Magoncia was selected to help review energy related grant materials during the summer of 1981. As student consultant she was to make recommendations for high school study projects on national energy conservation. Magonicia was one of two student representatives on the eighteen-member national panel.

Adult Education Class

In January Richmond, with student help, expanded Creswell's solar horizons by offering "Solar Energy--Principles and Practices," an evening adult education class at Creswell High School. The ten-week course, open to students and community members, was sponsored by Lane Community College, and credit for the course was available through the high school. Expecting a maximum of fifteen in the class, Richmond was surprised to find an enrollment of forty-five.

In the winter two sections were offered that taught heat loss prevention, insulating techniques, and how to build solar projects. A waiting list for spring term was started. By demand the spring class was a repeat of winter term. Students in the classes included truck drivers, engineers, construction workers, a retired eighty-five year old minister, power company employees, housewives, and representatives of the counter culture.

Nomination for National Award

Early in 1981 the state superintendent of education nominated Creswell's energy efficient construction program for the federal secretary of education's "Award for Recognition of Initiative." Seven other programs from Region X--Alaska, Idaho, Oregon, and Washington--had been nominated for the national award that only one project in the region could win.

Creswell's construction program was nominated because it met three of the four national criteria for recognition: energy conservation, youth employment, equal access for instruction in nontraditional programs for women and minorities, and economic development. Creswell's construction cluster emphasized energy conservation at all levels, provided summer employment in conjunction with CETA, and had one of the highest percentages of women enrolled in a constructional curriculum in Oregon, 30 to 40 percent.

In February a federal review board from the Seattle office of the Department of Education inspected Creswell's program. The board was pleased by the quality of the project, but it did not give Creswell the award.

Energy Road Show

March 20, 1981, was declared National Energy Day by President Carter and Oregon Energy Day by Governor Atiyeh. Thirty-three Creswell vocational construction students designed the "Energy Road Show" for National Energy Day. It presented displays on solar, geothermal and wind energy, energy conservation, recycling, micro-hydro power, solar space heating systems, and weatherization. The Road Show was put together by students with a minimum of adult guidance.

The travelling display included a scale model of Creswell's solar greenhouse built by students Kevin Phillips and Jamie Bostick. It also had a working sample of a domestic solar hot water system, ten student-built solar collectors that had been assembled during the school year, and two handmade models of wind generators. A continuous slide show reviewed Creswell's past energy project. The Road Show was taken to Creswell's elementary and middle schools and the high school. Finally, it was set up in downtown Creswell. In addition to newspaper coverage, Eugene television station KVAL carried two stories about the school's activities that

day. Senator Mark Hatfield and other dignitaries viewed the exhibit and visited with students about solar energy.

In competition with other Oregon students, Creswell's contribution to National Energy Day was chosen as Oregon's best effort. Each state selected only one program to be sent to Washington, D.C., for the National Awards Ceremony in June 1981. The National School Boards Association and the federal Department of Energy paid all expenses to Washington for one student and his or her advisor from each state. Creswell's school board allocated additional money for a second student to attend the ceremonies as well. Jim Richmond, the instructor, Rogelia Magoncia, president of Creswell's Vocational Construction Organization, and Barbara Lowry were selected for the trip. In a related development, Lee Kirkby, another vocational construction student, was appointed Oregon State director for National Energy Education Day 1982. Part of his training involved a student leadership program in Tennessee.

The Third Year

Creswell could not make use of state/federal grants for 1981-82 as it had for the first two years of its project. No similar funds were available. However, energy efficient construction continues to be alive and well. Construction Supervision, a class for seniors, is being offered for the first time. Both of its students are female. Construction I has fifteen students, five of whom are females. Construction II has fourteen students, six of whom are females. Forty-one percent of the construction cluster's enrollment is made up of female students, the highest percentage in its three-year history.

The focus of the program continues to be on solar energy. Finishing touches will be completed on the school's solar greenhouse, and its grand

opening will be held during this school year. Students will begin other greenhouses in order to continue learning about energy efficient construction. Future greenhouses, however, will be built within the community. A number of eager homeowners in Creswell have inquired about having greenhouses built. Currently it is being determined which proposed site would be best suited to students' learning needs. Building costs would be paid by the future owner while students would continue to learn on-the-job construction skills.

Classes will continue to build solar collectors, but this year they will be put into aluminum frames rather than wood. The collectors will be sold to the public and the money from the sale returned to the construction budget. Students are helping to build a creative playground at the elementary school and constructing new toilet facilities for the bus garage. They will also be building an addition to the high school gymnasium and a storage area for the elementary school. There is the possibility of installing a complete solar collector system to supply hot water for the school district's new office building.

The school district continues to support the construction cluster program with a total budget of about $5,000, not counting instructional salaries. About $800 to $1,000 will be returned to the construction fund by the eventual sale of solar collectors. Jim Richmond continues to be asked to go on speaking tours, and more and more schools learn about energy efficient construction in the curriculum.

Two Special Projects

Solar Hot Water Collectors

Creswell purchased solar hot water collector kits from Sun Mart, Inc. of Corvallis, Oregon. Each kit had enough materials to build one four-by-eight feet collector. The kits included 3/4" copper annealed headers with 3/8" copper heat tubes that needed to be cut to size by the builder, prestamped aluminum heat absorbing fins, adhesive, cleaning abrasives, and assembly instructions. Both plumbing and carpentry skills were needed to assemble a collector.

Construction I students were organized into four-person teams. Each team had the responsibility of building one collector. The construction trainees had to use common plumbing trade skills such as preparation of copper parts, cleaning, fluxing, soldering, cutting, and fitting of copper tubing. First, heat absorber tubes were cut to size and connected to the headers. Next aluminum fins were attached to the tubes with thermal mastic. Collector box frames were made from 2 x 4's and plywood using regular shop tools and techniques. Before the copper collector panels were inserted into their frames, students pressure tested them to one hundred and twenty pounds per square inch for leaks.

Each work team was evaluated on the quality of construction, appearance, and function of its collector. Three of the four panels made by that first-year class were sold to the public and the money turned over to the district to help finance construction of the passive solar geenhouse during the second semester. One of the three was sold as a swimming pool preheater and installed by the class in exchange for a barbeque and swimming party. The fourth panel was installed where its performance could be monitored

and was later incorporated into Creswell's exhibit at Oregon State University's Youth Energy Awareness Day in February 1980.

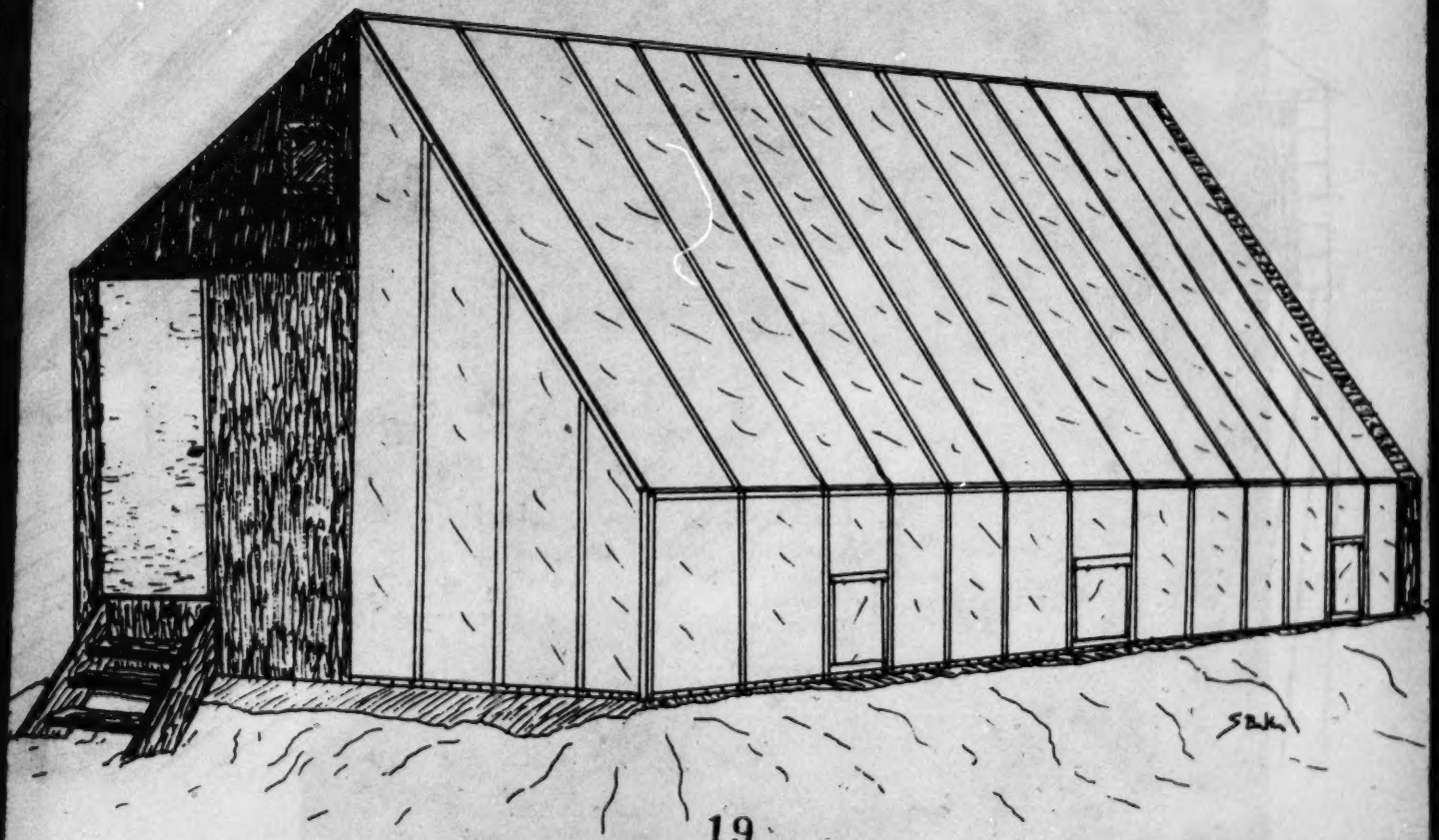
The Solar Greenhouse

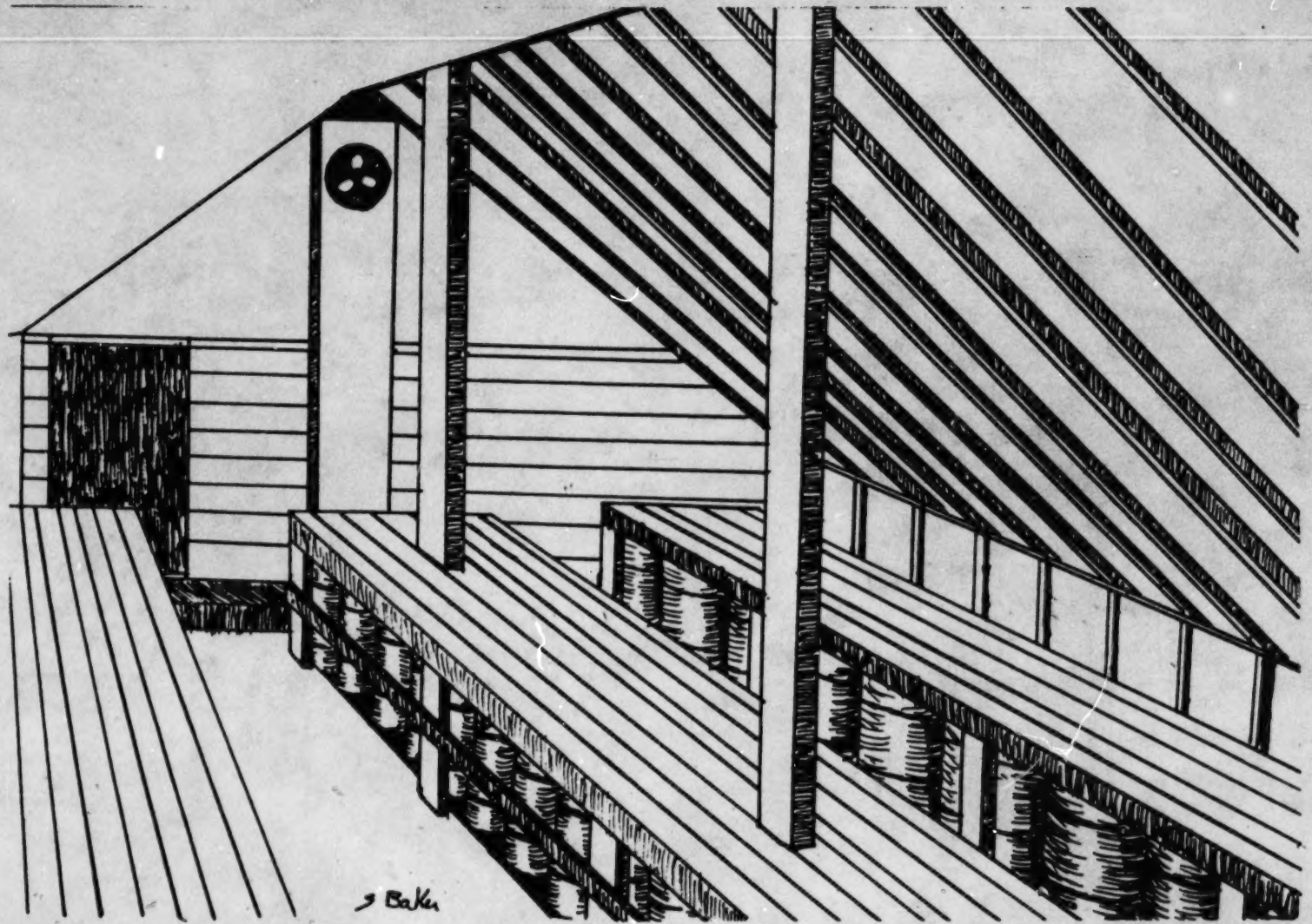
"The kids built the greenhouse," Jim Richmond explained. "I drove maybe five nails in the whole thing. It's entirely student built and in some parts of it, it shows. But then you don't expect perfection out of anyone short of a journeyman--and nowdays even that may be doubtful."

The project through which Creswell High School eventually received the most attention was the student designed and built hybrid solar passive greenhouse. Originally planned as a modest structure, the final construction blossomed into 480 square feet of floor space with over ten tons of thermal mass inside. The accompanying drawings of the solar greenhouse are by Creswell High School students Steve Baker (interior/exterior perspective) and Alan Doney (floor plan).

The greenhouse was begun during the 1979-80 school year. The finishing touches will be completed soon, and the formal grand opening is scheduled for January 1982. It has served as a learning experience and an example of energy efficient construction for Creswell students throughout the three-year life of the construction cluster program.

The greenhouse is thirty feet long, sixteen feet wide, and fourteen feet high. Site considerations dictated the eventual size and shape of the building. The solar greenhouse's east side is connected to the school's vocational agriculture classroom. Bordering the classroom's other side is the school's original uninsulated, energy inefficient conventional greenhouse. The old greenhouse with its single glaze glass has to be heated with natural gas even on summer nights. When the solar greenhouse becomes





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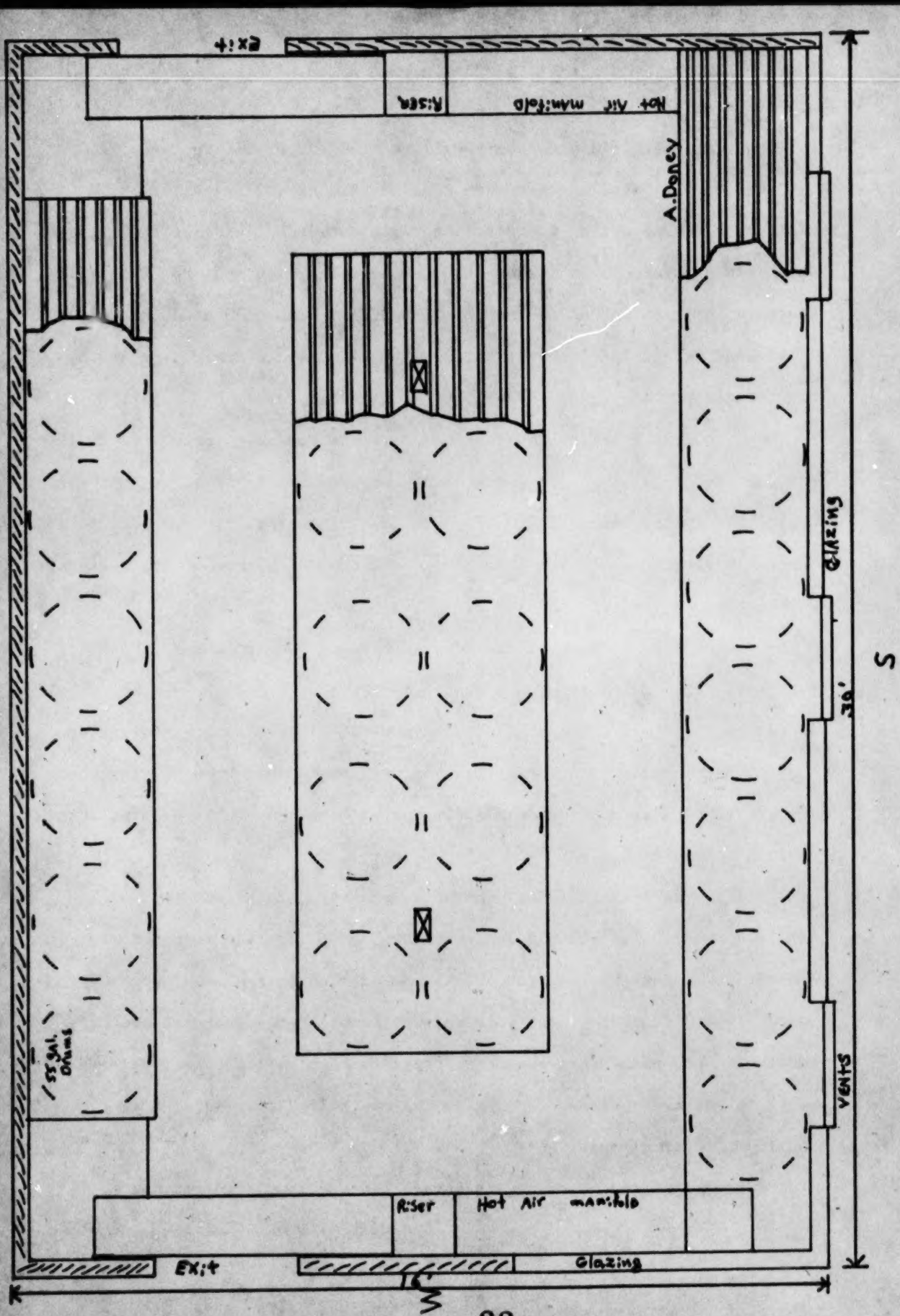
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fully operable the old greenhouse will be used in conjunction with it.

Building the solar greenhouse required almost all the skills of residential construction from students. The students laid out the site, which was excavated by a member of Creswell's school board, Mel McNeill. Students built forms and poured the foundation. The wood used in the forms was reused later in the construction. Students placed drain pipe around the foundation and graded gravel for drainage purposes.

Gradually the greenhouse took shape over a two-year period. With its various challenges students learned and used the skills of carpentry, masonry, sealing, framing, insulating, duct work, and finishing. In contrast to the "energy sieve" conventional greenhouse, the new solar greenhouse is tightly weatherproofed and well insulated.

The double-glazed walls of the solar greenhouse are the south facing roof-wall, the four-feet high kneewall on the south, and the southwest half of the west endwall. The south facing roof-wall has a forty-nine degree slope. High grade glazing material was used that could be easily patched in case of accidents. The dead air space between the double glazing acts as additional insulation.

Solar heat is retained by the large quantity of thermal mass within the greenhouse. Two hundred and fifty feet of perforated septic drain pipe are buried in the thirty-five cubic yards of rock that lie below the greenhouse floor. Concrete slabs form walkways among the greenhouse counters. Underneath the plant shelves are forty fifty-five gallon drums, painted black to act as passive solar collectors and filled with water for additional thermal mass.

The goal of the thorough insulation job and the large thermal mass is

to be able to maintain moderate temperatures inside the greenhouse for several days during cloudy and cool weather. Even on cold days 60 to 75 percent of the greenhouse's heat will come from the sun's energy stored as thermal reserve.

Several climate control systems are meant to stabilize temperatures. A reversible fan with sealing louvres is installed in the wall joining the heated classroom. When temperatures drop too low in the greenhouse, heat will be drawn from the classroom. When the greenhouse temperature climbs too high, excessive heat can be exhausted into the classroom. Five freon-activated vents also assist in venting extra heat without the use of electricity. These can be temperature-set to open ceiling vents and release built up heat. As with all greenhouses of this kind, fine tuning and experimentation must occur before it is put into full operation. The vocational agriculture class will inherit the greenhouse and use it for its many projects beginning in 1982.

Assessment of the Program's Success

When Creswell first proposed its innovative construction program it set out three specific goals: (1) to increase the number of students in the vocational program by 10 percent; (2) to decrease the dropout rate; and (3) to increase the job readiness skills of students. In the eyes of all involved the project has more than accomplished its objectives.

The number of vocational students in the high school has increased by 30 percent. More than 15 percent of the student body has become involved in energy efficient construction. The program has proved to be such a success that the Creswell district continues to fund it with a budget that is a 400 percent increase over the district's contribution the first year.

Although precise figures were not kept regarding the school's dropout rate, both Jim Richmond and Bob Kane, the high school principal, believe the vocational program has had a significant impact. "There are kids," says Richmond, "who are fiercely defensive about construction--it's <u>their</u> course. In some cases maybe 30 percent of my students would not be here if it weren't for the success and recognition they've received for being involved in the program."

Kane agrees. "I've seen kids do remarkable turn arounds," he explains. "I can think of four or five students that when I first arrived I didn't think would ever stay in school. Their attitudes were extremely negative and warranted extended services."

Out of thirty students who have completed the construction cluster sequence, only two did not graduate. "And those have been heartbreak," says Richmond. "Home problems and other difficulties caused them to choose other options."

Minorities, women, and the handicapped were successfully recruited into the program. Thirty percent of the students were classified as handicapped under P.L. 94-142 in the second year of operation. Special efforts were made to encourage participation by the few minority students in the high school. The most impressive gains were made in female enrollment. In the two years prior to energy efficient construction only one female had taken a shop class. In the 1981-82 school year, 40 percent of construction students are women. They not only have been enrolled but have excelled in the program. Construction club officers have been female, and two of the women students represented the school in Washington, D.C. "It's important," points out Bob Kane, "to give women, who in our society today face a fifty-fifty chance of a divorce or long unmarried time, a global education so that they can feel capable of taking care of themselves just as men can."

Skills students have learned in the construction cluster can certanly be used in job settings. Energy efficient buildings must be tightly sealed and well constructed. That requires skill. The impact of the program, however, has been broader than just training future carpenters. Richmond points to the success students have experienced and the leadership ability they have developed. The construction courses have given many students more confidence in themselves. Students who have gone through the sequence have made gains in other areas of their lives as well. One young woman, seen as a potential dropout, was selected by school counselors as the most academically improved student by the time she graduated. "She went on to earn $400 a month more than I do," laughs Richmond. "Her job was not construction related, but her success was related to the self-confidence she developed in the course."

Implication for Other Schools

Personnel and Philosophy

A number of elements have contributed to the success of Creswell's energy efficient program. As in all outstanding programs, good personnel are critical. Jim Richmond is exceptional in his enthusiasm for solar energy and his ability to work well with young people and the school administration. Not every school has the "Richmond magic," as Bob Kane calls it. Richmond, on the other hand, insists that other schools can have a program similar to Creswell's. "It's important in small schools to give kids vocational experience and it's often difficult because it's expensive. I'll admit that it's a challenge at times to create something exciting that kids can have a feeling of pride and success in doing, something different and unusual, and something that relates to our future needs, but energy efficiency is the answer."

From the students' point of view, one of the attractions of the program has indeed been its emphasis on energy efficiency. Solar energy has proved to be a useful vehicle for Creswell to create an innovative and exciting course sequence. Energy efficient construction looks to the future. "We look at not only construction details, careers in construction, and the future of construction, but we look at how housing meets the human needs," says Richmond. "The overall direction of the program is to teach that we cannot afford to build 2 x 4 stick houses, unchanging since the 1930's when we had virtually free energy. We need to look at making housing environmentally responsible."

As a means of putting vocational experience in the reach of small schools, Creswell has developed a particular philosophy toward vocational

classes. In Creswell, vocational education at the high school level is seen as exploratory. "Vocational education is for anybody who is willing to attempt it," states Principal Bob Kane. "There are a lot of people in schools who will never be craftsmen. Vocational education should also be for them."

This means that the instructor must be blessed with patience enough to allow students to make mistakes and learn from them. Generally, Kane points out, vocational classes put too much emphasis on the finished product, and as a result personal growth is negated. Jim Richmond echoes this sentiment, "The last thing on earth you want to do is to be so concerned about the quality of the project that you don't allow kids to experience the joy of building something."

Patience is a key to success. Both the individual teacher and the district must be patient. "You must let students make a mistake, then take them back through it to rectify the mistake. This causes them to take a long time in building," Richmond points out, "but does get the job of teaching done." Some projects like the smoking area took Creswell students several attempts before it was finished correctly.

"When you're dealing with students and a teacher on a project, it may take months and months," Superintendent Stuart Young explains.

> Basically you're dealing with an attitude. The instructors have to have some kind of vision of where they want to go with their projects. They've got to mesh with the district's long range goals or plans, but at the same time there has to be an understanding that students don't always do things right the first time. If it's urgent to get something done and you need a professionally perfect job, you'll have plenty of built-in frustrations from the beginning. There has to be a willingness on the part of the administrator, the high school principal, to have confidence in the people he has there--that they will be competent in overseeing the projects they are working on.... This attitude has to permeate the system. Energy efficient construction is a neat program, but I think a key to it is personnel. You've got to have the people, and have to develop the right attitude.

Funding

Naturally funding is an important element in beginning and maintaining a program. Two years of state and federal funding totalling $32,000 allowed Creswell to buy equipment and materials that can be used for many years. "Through the two grants that began the project we developed a tremendous resource library in media and print," verified Richmond. "I think I can say that we have the largest energy education library that exists in a school anywhere in the United States. We have as much as four or five thousand dollars of media equipment, filmstrips, slide shows, and cassette presentations." In addition to the resource library, the school has the nearly completed solar greenhouse that will be used by the school's vocational agriculture program. Obviously, not every school is going to be as fortunate as Creswell in attracting grant money.

Funding for special projects is difficult for most school districts. Creswell developed a talent for well written and thorough requests for grants. Its applications were strengthened by stressing areas like sex equity, access for the disadvantaged and handicapped, and energy awareness. State and federal funds provided the basis for Creswell's construction program.

However, as Ralph Little of the Division of Vocational Education in the state Department of Education warns, funding patterns are changing. Availability of funds is dependent on rapidly changing federal and state budget considerations. Little suggests checking three sources for additional money to start a program like Creswell's. The last word from the Department of Energy was that there still existed some money for projects in schools. In the last version of the state budget plan there were still some funds for innovative and exemplary construction programs in schools. If these

sources fail, there is still the basic grants available from the Division of Vocational Education.

Schools having vocational programs are aware of the formula used to determine each school's portion. Schools wanting to begin a state approved vocational program must make applications to Vocational Education. Over the last three years, for example, Creswell received an average of around $4,000 a year in basic grant payments. This was divided among all its vocational classes.

Superintendent Young acknowledges that two years of grants were exceedingly helpful in establishing Creswell's construction program. He points out, moreover, that the district's own financial commitment to its vocational program is not particularly high compared to other school districts of its size. The vocational construction course's annual supply budget in 1981-82 is around $4,000. It is important to remember, however, that one of the unique aspects of this program has been to repay the district through construction. A certain amount of cash returns to the district through the sale of solar collectors. Using admittedly rough estimates of cost, Richmond figures the construction class has build projects for the school district that run close to $12,000 in value for an actual expense of around $8,000. (Using a similar approach, Ken Ball's vocational agriculture class saved the district nearly $17,000 with a special drainage project.)

Special Considerations

Most districts are not going to be able to afford the cost of a media library like the one Creswell has accumulated with its grant monies.

One feature of the district's energy efficient construction program has been the use of individualized instruction through the use of media. "If you stick these kids in a classroom and try to present materials in a lecture format, you will fail," says Jim Richmond. "The thing that has worked best for them is the media. These are boob-tube raised kids, and if I give a lecture on solar energy, I'll lose half of them; but if I give a film presentation or filmstrip, or slide presentation, I won't lose them, or not nearly as many." As far as possible schools should keep this advice in mind.

The successful recruitment of women into the construction cluster has been just that--recruitment. Female students have been actively invited to enroll in the construction sequence. They have been assured that women are welcome in what has been traditionally a male dominated area. The instructor's attitude is very important. Gradually the picture is changing, but it is not an overnight venture. Creswell's experience has been that each year has meant an increase in female enrollment. Sex equity is still a goal yet to be achieved, but the construction cluster has demonstrated its ability to attract women to this vocational area.

Conclusion

How reproducible is Creswell's energy efficient construction program? "It's very practical," says Bob Kane, the high school principal. "I don't think it's that difficult. I really don't necessarily think that having a solar greenhouse in and of itself is so important. Basically it's a fairly simple curriculum device for smaller schools."

Creswell's solar greenhouse cost approximately $6,000 to build. In times of tight money that may be too much for many districts to contemplate. That's a decision that must be made by each district independently. As Kane says, however, the greenhouse itself is not the final goal. The goal in Creswell's program has been to stress energy efficient construction. Students have sharpened their building skills on practical necessary projects within the school district. They have applied their knowledge to needed construction. That seems to be one of the keys to Creswell's success. It has combined energy theories with practicality.

Small schools are capable of big projects. Creswell has a commitment to energy efficiency that has manifested itself in the shape of a greenhouse. Among schools of its size, Creswell appears to have one of the few solar greenhouses in the United States. In times of limited budgets Creswell's example demonstrates that a school district can afford to sustain a vocational construction program that is not necessarily dependent on special outside funds. Creswell's program is in good health and continues to explore new ways of implementation.

The energy efficient construction model is one that can be followed by other districts in whole or in part. It's utility is not restricted to the building of solar greenhouses and the assembly of solar collectors. The program has proved to be successful for Creswell. It can also be successful elsewhere.

Appendix

Addresses

For more information

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Interviews

Kane, Bob, principal, Creswell High School, Creswell School District, Oregon. Interview, October 13, 1981.

Richmond, Jim, teacher/career education coordinator, Creswell High School, Creswell School District, Oregon. Interview, October 13, 1981.

Young, Dr. Stuart, superintendent, Creswell School District, Oregon. Interview, November 17, 1981.